UCRL-JC-123252 Abs

Detection of 63Ni and 59Ni by AMS: Applications in Hiroshima Dosimetry and Biomedical Tracing.†

J. E. MCANINCH, L. J. HAINSWORTH, A. A. MARCHETTI, M. R. LEIVERS, P. JONES*, A. E. DUNLOP, R. MAUTHE, I. D. PROCTOR, T. STRAUME, J. S. VOGEL,

The reaction 63Cu(n,p)63Ni has been identified as one of a small number of reactions which might be used for the direct determination of the Hiroshima fast neutron fluence (Marchetti and Straume, 1995, Appl. Radiat. Isotop. ??). We have developed chemical techniques for the separation of 63Ni (t1/2 = 100 y) from bulk copper, followed by measurement of 63Ni by accelerator mass spectrometry. Electrochemical separation is used to isolate 63Ni and trace stable Ni from gram-sized copper samples. Stable Ni (1 mg) is added as a carrier. Reaction with carbon monoxide to form Ni(CO)4 is used to further reduce Cu to < 2 ¥ 10-8 (Cu/Ni). The Ni(CO)4 is thermally decomposed directly in sample holders for measurement by AMS. After analysis in the AMS spectrometer, the ions are identified using characteristic projectile x--rays. This allows the further rejection of the remaining 63Cu, which is a stable atomic isobar of 63Ni. In a demonstration experiment, 63Ni was measured in Cu wires (2-20 g)which had been exposed to a 252Cf source. We successfully measured 63Ni at levels necessary for the measurement of Cu samples exposed near the Hiroshima hypocenter. For the demonstration samples, the Cu was chemically reduced by a factor of 1012 with quantititative retention of 63Ni. Detection sensitivity (3() was ~20 fg 63Ni (63Ni/Ni (2 ¥ 10-11). A significant improvement in sensitivity is expected with incremental changes in the methods. Preliminary results indicate that a similar sensitivity is achievable for 59Ni (t1/2 = 105 y). We will report on initial work on the application of this isotope as a biomedical tracer in living systems.

† This work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under contract W-7405-Eng-48.

Lawrence Livermore National Laboratory, POB 808, Livermore, CA 94551-9900 USA
Corresponding author: mcaninch1@llnl.gov
*University of the Pacific, Stockton, CA USA